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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/160,965	09/25/98	SHUE	S TSMC97-542/9
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GEORGE O SAILE
20 MCINTOSH DRIVE
POUGHKEEPSIE NY 12603

MM91/0512

EXAMINER

KIELIN, E

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 05/12/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trad marks

Office Action Summary

Application No.
09/160,965

Applicant(s)
Shue et al.

Examiner
Erik Kielin

Group Art Unit
2813



☒ Responsive to communication(s) filed on Apr 27, 2000

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-12 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-9 is/are rejected.

☒ Claim(s) 10-12 is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☒ The proposed drawing correction, filed on Apr 27, 2000 is ☒ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Drawings

1. The corrected or substitute drawings were received on 4/27/00. These drawings are acceptable.

Specification

2. The disclosure is objected to because of the following informalities: (1) on page 5, line 8, insert "planarized by" after "and," and remove "the" for grammatical correctness and parallel wording of series. Appropriate correction is required.

Claim Objections

3. Amended Claim 3 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 1. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Examiner notes Applicant's amendment to include that metal "is etched away" by the reverse current electroplating. Merely including an inherent description of the means by which the same method recited in claims 1 and 3 removes the metal does not render the claim different. It

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remains a substantially duplicate of claim 1, not further limiting the scope of claim 1 and is therefore improper.

Claim Rejections - 35 USC § 112

Amendments obviate the need for the rejections.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (US 4,954,459) in view of Datta et al. (US 5,567,300).

Avanzino et al. discloses the same method for making “a highly planarized integrated circuit structure” as that disclosed the instant invention. Avanzino’s method employs forming a reverse tone photoresist mask which covers trenches but leaves exposed elevated regions, removing at least a portion of the elevated regions by etching, and then removing the photoresist and planarizing via CMP. (Abstract; Figs 3-9 and 10-16). Avanzino et al., however, employs the method to planarize oxides instead of metals such as copper, gold, tungsten, titanium, aluminum, and silver.

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Datta et al. and references cited therein teach the benefits of reverse current electroplating for the purpose of removing unwanted metal -- particularly copper -- regions for the purpose of planarizing (sections entitled "Planarization is desirable for two reasons" and "There are various planarization methods ").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the oxide used in Avanzino's equivalent method of planarization with the material of copper or other metal and the associated electrochemical processes to yield the instant invention because highly planarized layers are desired in the art.

Examiner asserts that sealing a copper layer with a capping layer after planarization is well-known in the art.

6. Claims 4 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Avanzino et al. (US 4,954,459) in view of Datta et al. (US 5,567,300).

Avanzino et al. and Datta et al. teach all of the limitations of claims 1-3 and 5-8 except for replacing the copper layer with gold, tungsten, titanium, aluminum, or silver. Applicant indicates, however, that copper can be replaced by gold, tungsten, titanium, aluminum, and silver (page 9, last line to page 10, line 2). The choice of metal is obvious because applicant indicates that the process works for each of the metals.

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Allowable Subject Matter

7. Claims 10-12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. For claim 11, the objection presented in paragraph 3 of this action but also be corrected.

The prior art does not teach or suggest the selective removal of the layer to be planarized according to the dimensions of trench spacing within some critical limit.

Response to Arguments

8. Applicant's arguments filed 4/27/00 in paper no. 4 have been fully considered but they are not persuasive.

Regarding Applicant's contention that the method in Avanzino et al. (Avanzino's method, hereafter) is not suitable for metals, Examiner respectfully cannot agree. Applicant's Representative alleges that Avanzino's method would not work for metals because the polishing to the substrate (denoted 2 in the Figures) surface would lead to dishing. If this is so, Examiner is at a loss to suggest a reason why this would not also happen with Applicant's method, as they are the same method merely with different materials. Compare Figures 3 to 9 of Avanzino et al. with Figures 2c to 2h of the instant invention.

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Applicant has employed an old method of planarization used for dielectric materials, wherein the elevated portions are removed by standard photolithographic techniques prior to CMP to enable more uniform planarization during to CMP, and applied it to damascene metallization. One of ordinary skill by merely looking at Figures 3-9 of Avanzino et al. would arrive at the instant invention. Were it not for the indication in the specification of Avanzino et al. that the material being planarized was a dielectric, there would be no way to know that the Figures 3-9 were not, instead, describing the instant invention's planarization of a damascene metallization.

Examiner agrees with Applicant's Representative concerning the incorporation of Datta which was to indicate that reverse electroplating was a means for removing undesired metal portions, for just the same purpose as Applicants are using it in the instant invention.

The traversal of the rejection of the remaining claims rests on the arguments against the rejections of Avanzino and therefore are retained for the same reasons presented above.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after

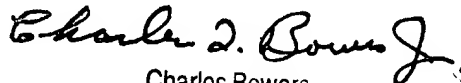
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the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980. The examiner can normally be reached by telephone on Monday to Friday 8:00 AM until 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached on (703) 308-2417. The fax phone number for the group is (703) 308-7722.

EK


Charles Bowers
Supervisory Patent Examiner
Technology Center 2800

May 11, 2000